In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
```

In [2]:
```
df = pd.read_csv("AirPassengers - AirPassengers.csv")
```

In [3]:
```
df.head(10)
```

Out[3]:

	Month	#Passengers
0	1949-01	112
1	1949-02	118
2	1949-03	132
3	1949-04	129
4	1949-05	121
5	1949-06	135
6	1949-07	148
7	1949-08	148
8	1949-09	136
9	1949-10	119

In [4]:
```
df
```

Out[4]:

	Month	#Passengers
0	1949-01	112
1	1949-02	118
2	1949-03	132
3	1949-04	129
4	1949-05	121
...	...	...
139	1960-08	606
140	1960-09	508
141	1960-10	461
142	1960-11	390
143	1960-12	432

144 rows × 2 columns

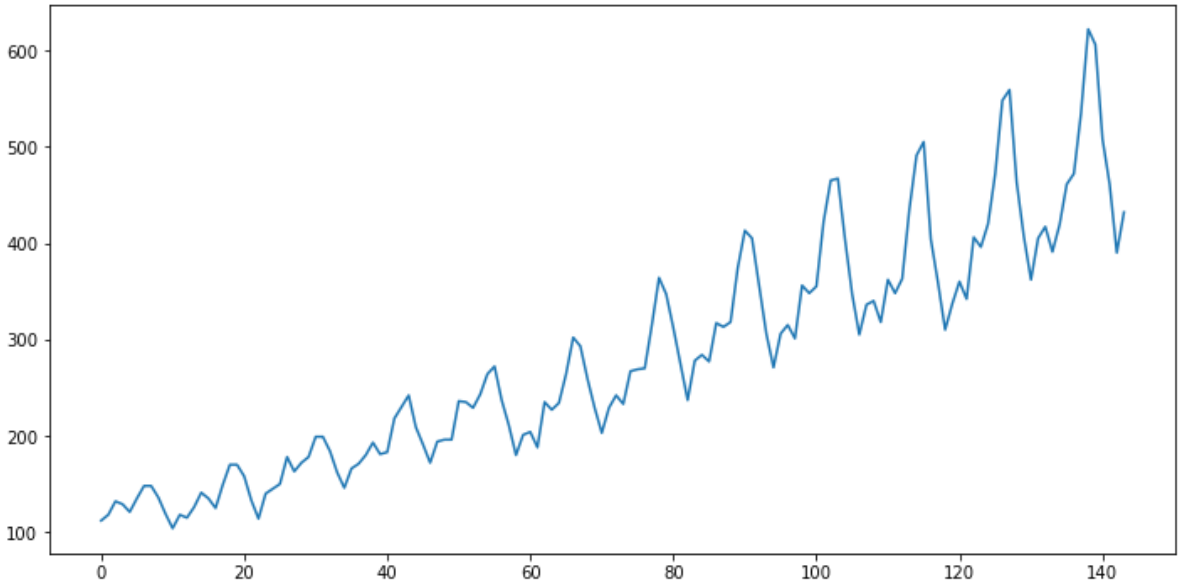
In [5]:
```
df.tail(10)
```

Out[5]:

	Month	#Passengers
134	1960-03	419
135	1960-04	461
136	1960-05	472
137	1960-06	535
138	1960-07	622
139	1960-08	606
140	1960-09	508
141	1960-10	461
142	1960-11	390
143	1960-12	432

In [6]:
```
plt.rcParams.update({"figure.figsize" : (12,6)})
df["#Passengers"].plot()
```

Out[6]: <AxesSubplot:>



Moving Average

1 . Simple Moving Average(SMA)

2 . Cumulative Moving Average(CMA)

3 . Exponential Moving Average(EMA/EWMA)

In [ ]:
```
```

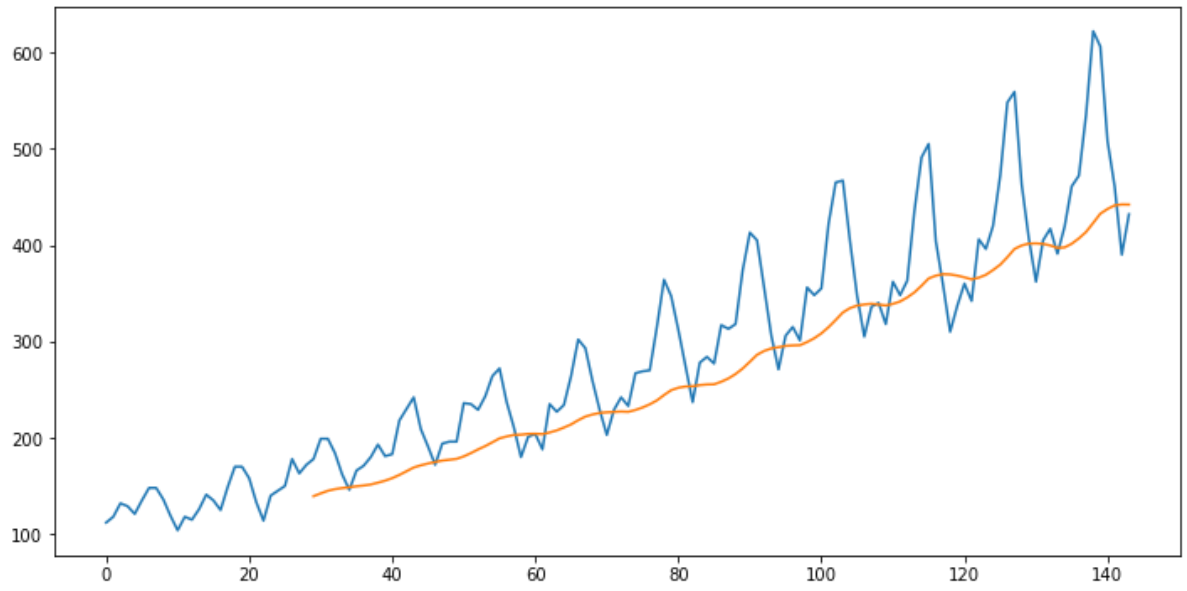
SMA

$$SMA_t = \frac{x_t + x_{t-1} + x_{t-2} + \ldots . x_{t-n}}{n}$$

In [13]:
```
df["SMA_30"] =  df["#Passengers"].rolling(window = 30).mean()
```

In [17]:
```
df["#Passengers"].plot()
df["SMA_30"].dropna().plot()
```

Out[17]: <AxesSubplot:>



Conclusion :

Passengers columns has Uptreand/Incresing Trend(Pattern)

CMA

$$CMA_t = \frac{x_1 + x_2 + \ldots . x_n}{n}$$

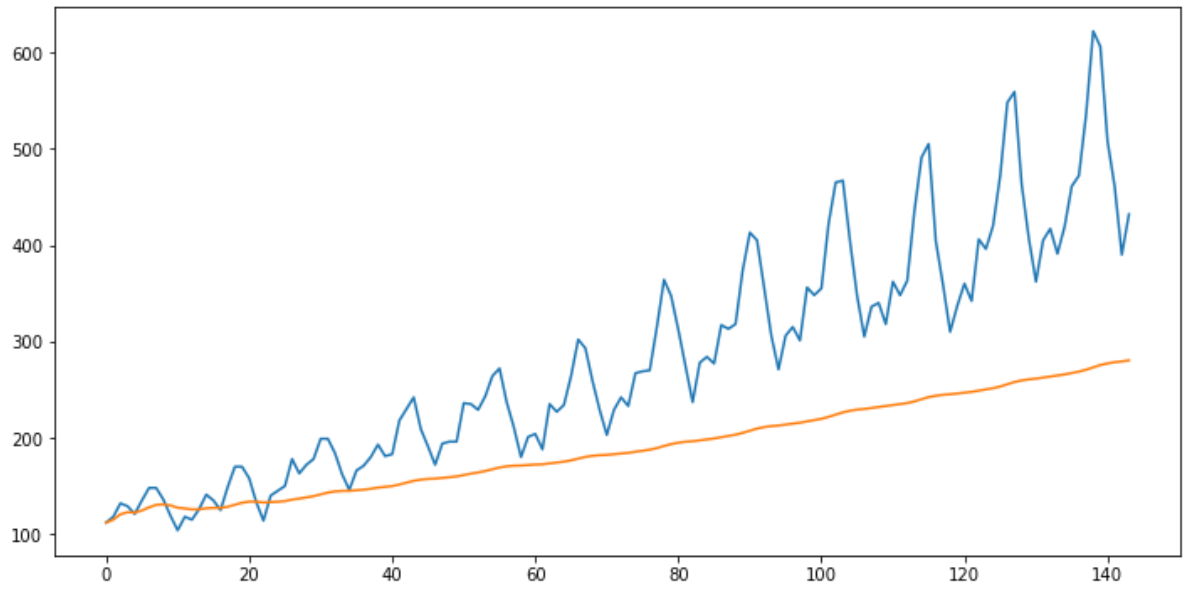
In [18]:
```
df["CMA"] = df["#Passengers"].expanding().mean()
```

In [20]:
```
df["CMA"]
```

Out[20]:
```
0      112.000000
1      115.000000
2      120.666667
3      122.750000
4      122.400000
          ...
139    275.514286
140    277.163121
141    278.457746
142    279.237762
143    280.298611
Name: CMA, Length: 144, dtype: float64
```

In [22]:
```
df["#Passengers"].plot()
df["CMA"].plot()
```

Out[22]: <AxesSubplot:>



EMA/EWMA

$$EMA_t = \alpha * x_t + (1 - \alpha) * EMA_(t - 1)$$

alpha is smoothing factors

Range of alpha is between 0 to 1

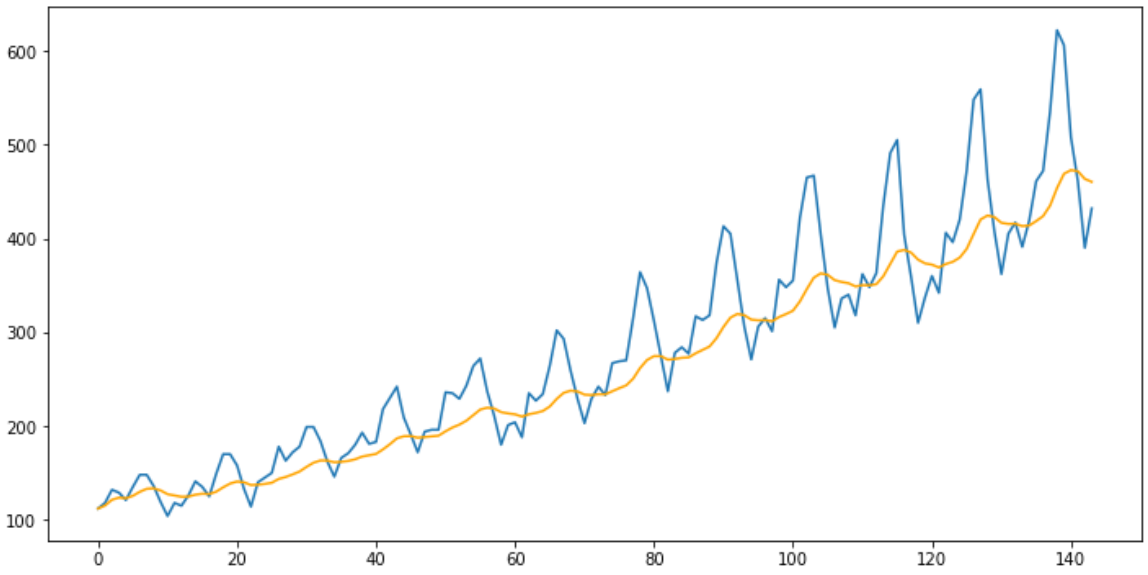
In [23]:
```
df["EMA_0.1"] = df["#Passengers"].ewm(alpha = 0.1).mean()
```

In [24]:
```
df["EMA_0.1"]
```

Out[24]:
```
0      112.000000
1      115.157895
2      121.372694
3      123.590579
4      122.957974
          ...
139    468.874660
140    472.787195
141    471.608475
142    463.447626
143    460.302862
Name: EMA_0.1, Length: 144, dtype: float64
```

In [27]:
```
df["#Passengers"].plot()
df["EMA_0.1"].plot(color = "orange")
```

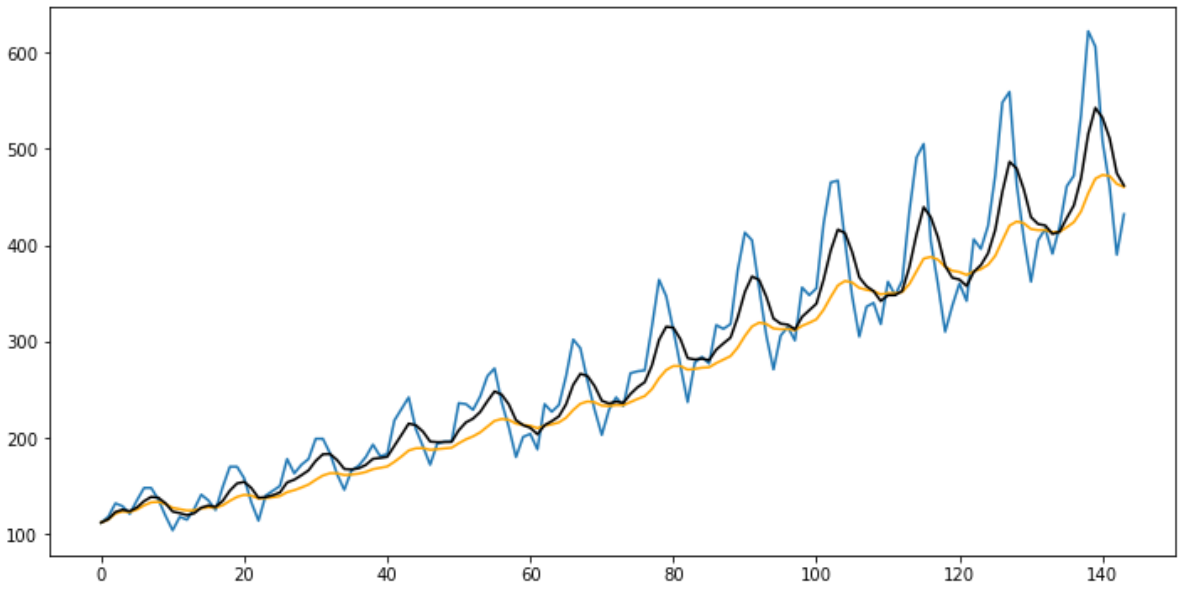
Out[27]: <AxesSubplot:>



In [30]:
```
df["EMA_0.3"] = df["#Passengers"].ewm(alpha = 0.3).mean()
```

In [33]:
```
df["#Passengers"].plot()
df["EMA_0.1"].plot(color = "orange")
df["EMA_0.3"].plot(color = "black")
```

Out[33]: <AxesSubplot:>



Conclusion

if we increase the value of alpha then the noise will also

In [ ]: